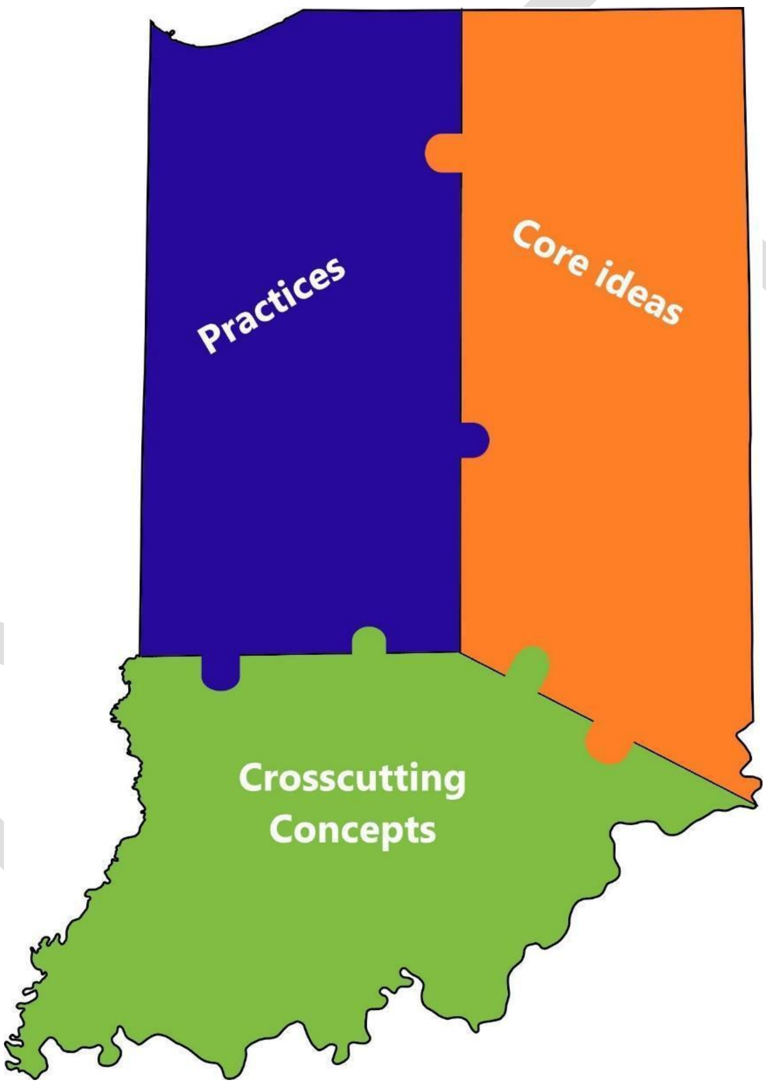
Indiana Academic Standards

Science



Grade 1

K-12 Science Indiana Academic Standards Overview

The K-12 Science Indiana Academic Standards are based on *A Framework for K-12 Science Education* (NRC 2012) and are meant to reflect a new vision for science education. The following conceptual shifts reflect what is new about these science standards. The K-12 Science Indiana Academic Standards

- reflect science as it is practiced and experienced in the real world,
- build logically from Kindergarten through Grade 12,
- focus on deeper understanding as well as application of content,
- integrate practices, crosscutting concepts, and core ideas.

The K-12 Science Indiana Academic Standards outline the knowledge and science and engineering practices that all students should learn by the end of high school. The standards are three-dimensional because each student performance expectation engages students at the nexus of the following three dimensions:

- Dimension 1 describes scientific and engineering practices.
- Dimension 2 describes crosscutting concepts, overarching science concepts that apply across science disciplines.
- Dimension 3 describes core ideas in the science disciplines.

Science and Engineering Practices

The eight practices describe what scientists use to investigate and build models and theories of the world around them or that engineers use as they build and design systems. The practices are essential for all students to learn and are as follows:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

The seven crosscutting concepts bridge disciplinary boundaries and unit core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas, and develop a coherent, and scientifically based view of the world. The seven crosscutting concepts are as follows:

1. *Patterns*- Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them.
2. *Cause and effect- Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity*- In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models*- Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for

understanding and testing ideas that are applicable throughout science and engineering.

5. *Energy and matter: Flows, cycles, and conservation*- Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function*- The way in which an object or living thing is shaped and its substructure determines many of its properties and functions.
7. *Stability and change*- For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Disciplinary Core Ideas

The disciplinary core ideas describe the content that occurs at each grade or course. The K-12 Science Indiana Academic Standards focus on a limited number of core ideas in science and engineering both within and across the disciplines and are built on the notion of learning as a developmental progression. The Disciplinary Core Ideas are grouped into the following domains:

- Physical Science (PS)
- Life Science (LS)
- Earth and Space Science (ESS)
- Engineering, Technology and Applications of Science (ETS)

The K-12 Science Indiana Academic Standards are not intended to be used as curriculum. Instead, the standards are the minimum that students should know and be able to do. Therefore, teachers should continue to differentiate for the needs of their students by adding depth and additional rigor.

Why use the Framework for K12 Science Education as the basis for the revision of science Indiana Academic Standards?

- The framework and standards are based on a rich and growing body of research on teaching and learning in science, as well as on nearly two decades of efforts to define foundational knowledge and skills for K-12 science and engineering.
- Studies show that even young children are naturally inquisitive and much more capable of abstract reasoning than previously thought. This means we can introduce elements of inquiry and explanation much earlier in the curriculum to help them develop deeper understanding.
- The new standards aim to eliminate the practice of "teaching to the test." Instead, they shift the focus from merely memorizing scientific facts to actually doing science—so students spend more time posing questions and discovering the answers for themselves.
- Historically, K-12 instruction has encouraged students to master lots of facts that fall under "science" categories, but research shows that engaging in the practices used by scientists and engineers plays a critical role in comprehension. Teaching science as a process of inquiry and explanation helps students think past the subject matter and form a deeper understanding of how science applies broadly to everyday life. This is in alignment with the Indiana Priorities for STEM education.
- These new standards support the research by emphasizing a smaller number of core ideas that students can build on from grade to grade. The more manageable scope allows teachers to weave in practices and concepts common to all scientific disciplines — which better reflects the way students learn.
- It is important that each standard be presented in the 3-dimensional format to reflect its scope and full intent.
- Given that each standard is a performance expectation (what students should know and be able to do), the standards are presented with some accompanying supports including clarification and evidence statements.

How to read the revised Science Indiana Academic Standards

Standard Number	**Title**	The title for a set of performance expectations is not necessarily unique and may be reused at several different grade levels

Students who demonstrate understanding can:

Standard Number **Performance Expectation: A statement that combines practices, core ideas, and crosscutting concepts together to describe how students can show what they have learned** [Clarification Statement: A statement that supplies examples or additional clarification to the performance expectation.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Activities that scientists and engineers engage in to either understand the world or solve the problem. There are 8 practices. These are integrated into each standard. They were previously found at the beginning of each grade level content standard and known as SEPs. **Connections to the Nature of Science** Connections are listed in either practices or the crosscutting concepts section.	Concepts in science and engineering that have broad importance within and across disciplines as well as relevance in people's lives To be considered core, the ideas should meet at least two of the following criteria and ideally all four: • Have broad importance across multiple sciences or engineering disciplines or be a key organizing concept of a single discipline; • Provide a key tool for understanding or investigating more complex ideas and solving problems; • Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge; • Be teachable and learnable over multiple grades at increasing levels of depth and sophistication. Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.	Seven ideas such as Patterns and Cause and Effect, which are not specific to any one discipline but cut across them all. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. **Connections to Engineering, Technology and Applications of Science** These connections are drawn from either the Disciplinary Core Ideas and Science and Engineering Practices.

Evidence Statements	
1	Evidence Statements provide educators with additional detail on what students should know and be able to do.
2	The evidence statements can be used to inform the scaffolding of instruction and the development of assessments.

1-PS4-1 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

Science and Engineering Practices

Planning and Carrying Out Investigations

Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct investigations collaboratively to produce evidence to answer a question.

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Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Science investigations begin with a question.
- Scientists use different ways to study the world.

Disciplinary Core Ideas

PS4.A: Wave Properties

- Sound can make matter vibrate, and vibrating matter can make sound.

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Observable features of the student performance by the end of the grade:			
1	Identifying the phenomenon under investigation		
	a	Students identify and describe* the phenomenon and purpose of the investigation, which include providing evidence to answer questions about the relationship between vibrating materials and sound.	
2	Identifying the evidence to address the purpose of the investigation		
	a	Students collaboratively develop an investigation plan and describe* the evidence that will result from the investigation, including:	
		i.	Observations that sounds can cause materials to vibrate.
		ii.	Observations that vibrating materials can cause sounds.
		iii.	How the data will provide evidence to support or refute ideas about the relationship between vibrating materials and sound.
	b	Students individually describe* (with support) how the evidence will address the purpose of the investigation.	
3	Planning the investigation		

	a	In the collaboratively developed investigation plan, students individually identify and describe*:
		i. The materials to be used.
		ii. How the materials will be made to vibrate to make sound.
		iii. How resulting sounds will be observed and described*.
		iv. What sounds will be used to make materials vibrate.
		v. How it will be determined that a material is vibrating.
4	Collecting the data	
	a	According to the investigation plan they develop, students collaboratively collect and record observations about:
		i. Sounds causing materials to vibrate.
		ii. Vibrating materials causing sounds.

1-PS4-2 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

1-PS4-2. Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated. [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

- Objects can be seen if light is available to illuminate them or if they give off their own light.

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that when an object in the dark is lit (e.g., turning on a light in the dark space or from light the object itself gives off), it can be seen.
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.
2	Evidence	
	a	Students make observations (firsthand or from media) to serve as the basis for evidence, including:
		i. The appearance (e.g., visible, not visible, somewhat visible but difficult to see) of objects in a space with no light.
		ii. The appearance (e.g., visible, not visible, somewhat visible but difficult to see) of objects in a space with light.
		iii. The appearance (e.g., visible, not visible, somewhat visible but difficult to see) of objects (e.g., light bulbs, glow sticks) that give off light in a space with no other light.
	b	Students describe* how their observations provide evidence to support their explanation.
3	Reasoning	
	a	Students logically connect the evidence to support the evidence-based account of the phenomenon. Students describe* lines of reasoning that include:
		i. The presence of light in a space causes objects to be able to be seen in that space.

		ii.	Objects cannot be seen if there is no light to illuminate them, but the same object in the same space can be seen if a light source is introduced.
		iii.	The ability of an object to give off its own light causes the object to be seen in a space where there is no other light.

1-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

1-PS4-3. Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).]

Science and Engineering Practices

Planning and Carrying Out Investigations

Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct investigations collaboratively to produce evidence to answer a question.

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

- Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon and purpose of the investigation, which include:
		i. Answering a question about what happens when objects made of different materials (that allow light to pass through them in different ways) are placed in the path of a beam of light.
		ii. Designing and conducting an investigation to gather evidence to support or refute student ideas about putting objects made of different materials in the path of a beam of light.
2	Identifying evidence to address the purpose of the investigation	
	a	Students collaboratively develop an investigation plan and describe* the data that will result from the investigation, including:
		i. Observations of the effect of placing objects made of different materials in a beam of light, including:
		1. A material that allows all light through results in the background lighting up.

		2. A material that allows only some light through results in the background lighting up, but looking darker than when the material allows all light in.
		3. A material that blocks all of the light will create a shadow.
		4. A material that changes the direction of the light will light up the surrounding space in a different direction.
	b	Students individually describe* how these observations provide evidence to answer the question under investigation.
3	Planning the investigation	
	a	In the collaboratively developed investigation plan, students individually describe* (with support):
		i. The materials to be placed in the beam of light, including:
		1. A material that allows all light through (e.g., clear plastic, clear glass).
		2. A material that allows only some light through (e.g., clouded plastic, wax paper).
		3. A material that blocks all of the light (e.g., cardboard, wood).
		4. A material that changes the direction of the light (e.g., mirror, aluminum foil).
		ii. How the effect of placing different materials in the beam of light will be observed and recorded.
		iii. The light source used to produce the beam of light.
4	Collecting the data	
	a	Students collaboratively collect and record observations about what happens when objects made of materials that allow light to pass through them in different ways are placed in the path of a beam of light, according to the developed investigation plan.

1-PS4-4 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. * [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drum beats.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Use tools and materials provided to design a device that solves a specific problem.

Disciplinary Core Ideas

PS4.C: Information Technologies and Instrumentation

- People also use a variety of devices to communicate (send and receive information) over long distances.

Crosscutting Concepts

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Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science, on Society and the Natural World

- People depend on various technologies in their lives; human life would be very different without technology.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students describe* a given problem involving people communicating over long distances.
	b	With guidance, students design and build a device that uses light or sound to solve the given problem.
	c	With guidance, students describe* the scientific information they use to design the solution.
2	Describing* specific features of the design solution, including quantification when appropriate	
	a	Students describe* that specific expected or required features of the design solution should include:
		i. The device is able to send or receive information over a given distance.
		ii. The device must use light or sound to communicate.
	b	Students use only the materials provided when building the device.
3	Evaluating potential solutions	
	a	Students describe* whether the device:
		i. Has the expected or required features of the design solution,
		ii. Provides a solution to the problem involving people communicating over a distance by using light or sound.
	b	Students describe* how communicating over long distances helps people.

1-LS1-1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.* [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Use materials to design a device that solves a specific problem or a solution to a specific problem.

Disciplinary Core Ideas

LS1.A: Structure and Function

- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

LS1.D: Information Processing

- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

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Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering and Technology on Society and the Natural World

- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Observable features of the student performance by the end of the grade:

1	Using scientific knowledge to generate design solutions		
	a	Students describe* the given human problem to be solved by the design.	
	b	With guidance, students use given scientific information about plants and/or animals to design the solution, including:	
		i.	How external structures are used to help the plant and/or animal grow and/or survive.
		ii.	How animals use external structures to capture and convey different kinds of information they need.
		iii.	How plants and/or animals respond to information they receive from the environment.
	c	Students design a device (using student-suggested materials) that provides a solution to the given human problem by mimicking how plants and/or animals use external structures to survive, grow, and/or meet their needs. This may include:	
		i.	Mimicking the way a plant and/or animal uses an external structure to help it survive, grow, and/or meet its needs.
		ii.	Mimicking the way an external structure of an animal captures and conveys information.

		iii. Mimicking the way an animal and/or plant responds to information from the environment.
2	Describing* specific features of the design solution, including quantification when appropriate	
	a	Students describe* the specific expected or required features in their designs and devices, including:
		i. The device provides a solution to the given human problem.
		ii. The device mimics plant and/or animal external parts, and/or animal information-processing
		iii. The device uses the provided materials to develop solutions.
3	Evaluating potential solutions	
	a	Students describe* how the design solution is expected to solve the human problem.
	b	Students determine and describe* whether their device meets the specific required features.

1-LS1-2 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. [Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).]

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

Scientists and engineers need to be communicating clearly and articulating the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as, orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world.

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Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms

- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

Crosscutting Concepts

Patterns

- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Observable features of the student performance by the end of the grade:			
1	Obtaining information		
	a	Students use grade-appropriate books and other reliable media to obtain the following scientific information:	
		ii.	Information about the idea that both plants and animals can have offspring.
		ii.	Information about behaviors of animal parents that help offspring survive (e.g., keeping offspring safe from predators by circling the young, feeding offspring).
		iii.	Information about behaviors of animal offspring that help the offspring survive (e.g., crying, chirping, nuzzling for food).
2	Evaluating information		
	a	Students evaluate the information to determine and describe* the patterns of what animal parents and offspring do to help offspring survive (e.g., when a baby cries, the mother feeds it; when danger is present, parents protect offspring; some young animals become silent to avoid predators).	

1-LS1-3 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

1-LS1-3. Develop representations to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

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Disciplinary Core Ideas

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- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

Crosscutting Concepts

Patterns

- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

1-LS3-1 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. [Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and a particular breed of dog looks like its parents but is not exactly the same.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

LS3.A: Inheritance of Traits

- Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents.

LS3.B: Variation of Traits

- Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

Crosscutting Concepts

Patterns

- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Observable features of the student performance by the end of the grade:			
1	Articulating the explanation of phenomena		
	a	Students articulate a statement that relates a given phenomenon to a scientific idea, including the idea that young plants and animals are like, but not exactly like, their parents (not to include animals that undergo complete metamorphosis, such as insects or frogs).	
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.	
2	Evidence		
	a	Students describe* evidence from observations (firsthand or from media) about patterns of features in plants and animals, including:	
			Key differences between different types of plants and animals (e.g., features that distinguish dogs versus those that distinguish fish, oak trees vs. bean plants).
		ii.	Young plants and animals of the same type have similar, but not identical features (e.g., size and shape of body parts, color and/or type of any hair, leaf shape, stem rigidity).
		iii.	Adult plants and animals (i.e., parents) of the same type have similar, but not identical features (e.g., size and shape of body parts, color and/or type of any hair, leaf shape, stem rigidity).
		iv.	Patterns of similarities and differences in features between parents and offspring.
3	Reasoning		
	a	Students logically connect the evidence of observed patterns in features to support the evidence-based account by describing* chains of reasoning that include:	
		i.	Young plants and animals are very similar to their parents.

		ii.	Young plants and animals are not exactly the same as their parents.
		iii.	Similarities and differences in features are evidence that young plants and animals are very much, but not exactly, like their parents.
		iv.	Similarities and differences in features are evidence that although individuals of the same type of animal or plant are recognizable as similar, they can also vary in many ways.

1-ESS1-1 Earth's Place in the Universe

Students who demonstrate understanding can:

1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted. [Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.]

Science and Engineering Practices

Analyzing and Interpreting Data

Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: "Does this make sense?" "Could my results be duplicated?" and/or "Does the design solve the problem with the given constraints?" SEPS.5 Using mathematics and computational thinking

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

Disciplinary Core Ideas

ESS1.A: The Universe and its Stars

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

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Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes natural events happen today as they happened in the past.
- Many events are repeated.

Observable features of the student performance by the end of the grade:

1	Organizing data		
	a	With guidance, students use graphical displays (e.g., picture, chart) to organize data from given observations (firsthand or from media), including:	
		i.	Objects (i.e., sun, moon, stars) visible in the sky during the day.
		ii.	Objects (i.e., sun, moon, stars) visible in the sky during the night.
		iii.	The position of the sun in the sky at various times during the day.
		iv.	The position of the moon in the sky at various times during the day or night.
2	Identifying relationships		
	a	Students identify and describe* patterns in the organized data, including:	
		i.	Stars are not seen in the sky during the day, but they are seen in the sky during the night.
		ii.	The sun is at different positions in the sky at different times of the day, appearing to rise in one part of the sky in the morning and appearing to set in another part of the sky in the evening.

		iii. The moon can be seen during the day and at night, but the sun can only be seen during the day.
		iv. The moon is at different positions in the sky at different times of the day or night, appearing to rise in one part of the sky and appearing to set in another part of the sky.
3	Interpreting data	
	a	Students use the identified patterns of the motions of objects in the sky to provide evidence that future appearances of those objects can be predicted (e.g., if the moon is observed to rise in one part of the sky, a prediction can be made that the moon will move across the sky and appear to set in a different portion of the sky; if the sun is observed to rise in one part of the sky, a prediction can be made about approximately where the sun will be at different times of day).
	b	Students use patterns related to the appearance of objects in the sky to provide evidence that future appearances of those objects can be predicted (e.g., when the sun sets and can no longer be seen, a prediction can be made that the sun will rise again in the morning; a prediction can be made that stars will only be seen at night).

1-ESS1-2 Earth's Place in the Universe		
Students who demonstrate understanding can: **1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.** [Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary. Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. ● Make observations (firsthand or from media) to collect data that can be used to make comparisons.	**ESS1.B: Earth and the Solar System** ● Seasonal patterns of sunrise and sunset can be observed, described, and predicted.	**Patterns** ● Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon and purpose of the investigation, which include the following idea: the relationship between the amount of daylight and the time of year.
2	Identifying evidence to address the purpose of the investigation	
	a	Based on the given plan for the investigation, students (with support) describe* the data and evidence that will result from the investigation, including observations (firsthand or from media) of relative length of the day (sunrise to sunset) throughout the year.
	b	Students individually describe* how these observations could reveal the pattern between the amount of daylight and the time of year (i.e., relative lightness and darkness at different relative times of the day and throughout the year).
3	Planning the investigation	
	a	Based on the given investigation plan, students describe* (with support):
		i. How the relative length of the day will be determined (e.g., whether it will be light or dark when waking in the morning, at breakfast, when having dinner, or going to bed at night).

		ii. When observations will be made and how they will be recorded, both within a day and across the year.
4	Collecting the data	
	a	According to the given investigation plan, students collaboratively make and record observations about the relative length of the day in different seasons to make relative comparisons between the amount of daylight at different times of the year (e.g., summer, winter, fall, spring).

K-2-ETS1-1 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-1. **Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems A practice of science is posing and refining questions that lead to descriptions and explanations of how the natural and designed world(s) work and these questions can be scientifically tested. Engineering questions clarify problems to determine criteria for possible solutions and identify constraints to solve problems about the designed world. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. ● Ask questions based on observations to find more information about the natural and/or designed world(s). ● Define a simple problem that can be solved through the development of a new or improved object or tool.	**ETS1.A: Defining and Delimiting Engineering Problems** ● A situation that people want to change or create can be approached as a problem to be solved through engineering. ● Asking questions, making observations, and gathering information are helpful in thinking about problems. ● Before beginning to design a solution, it is important to clearly understand the problem.	

Observable features of the student performance by the end of the grade:			
1	Addressing phenomena of the natural or designed world		
	a	Students ask questions and make observations to gather information about a situation that people want to change. Students' questions, observations, and information gathering are focused on:	
		i.	A given situation that people wish to change.
		ii.	Why people want the situation to change.
		iii.	The desired outcome of changing the situation.
2	Identifying the scientific nature of the question		
	a	Students' questions are based on observations and information gathered about scientific phenomena that are important to the situation.	
3	Identifying the problem to be solved		
	a	Students use the information they have gathered, including the answers to their questions, observations they have made, and scientific information, to describe* the situation people want to change in terms of a simple problem that can be solved with the development of a new or improved object or tool.	
4	Defining the features of the solution		
	a	With guidance, students describe* the desired features of the tool or object that would solve the problem, based on scientific information, materials available, and potential related benefits to people and other living things.	

K-2-ETS1-2 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science and Engineering Practices

Developing and Using Models

A practice of both science and engineering is to use and construct conceptual models that illustrate ideas and explanations. Models are used to develop questions, predictions and explanations; analyze and identify flaws in systems; build and revise scientific explanations and proposed engineered systems; and communicate ideas. Measurements and observations are used to revise and improve models and designs. Models include, but are not limited to: diagrams, drawings, physical replicas, mathematical representations, analogies, and other technological models. Another practice of both science and

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a representation of an object and the problem it is intended to solve. In their representation, students include the following components:	
		i.	The object.
		ii.	The relevant shape(s) of the object.
		iii.	The function of the object.
	b	Students use sketches, drawings, or physical models to convey their representations.	
2	Relationships		
	a	Students identify relationships between the components in their representation, including:	
		i.	The shape(s) of the object and the object’s function.
		ii.	The object and the problem it is designed to solve.
3	Connections		
	a	Students use their representation (simple sketch, drawing, or physical model) to communicate the connections between the shape(s) of an object, and how the object could solve the problem.	

K-2-ETS1-3 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Science and Engineering Practices

Analyzing and Interpreting Data

Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: "Does this make sense?" "Could my results be duplicated?" and/or "Does the design solve the problem with the given constraints?" SEPS.5 Using mathematics and computational thinking

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended.

Disciplinary Core Ideas

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Crosscutting Concepts

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	With guidance, students use graphical displays (e.g., tables, pictographs, line plots) to organize given data from tests of two objects, including data about the features and relative performance of each solution.
2	Identifying relationships	
	a	Students use their organization of the data to find patterns in the data, including:
		i. How each of the objects performed, relative to:
		1. The other object.
		2. The intended performance.
		ii. How various features (e.g., shape, thickness) of the objects relate to their performance (e.g., speed, strength).
3	Interpreting data	
	a	Students use the patterns they found in object performance to describe*:
		i. The way (e.g., physical process, qualities of the solution) each object will solve the problem.

		ii.	The strengths and weaknesses of each design.
		iii.	Which object is better suited to the desired function, if both solve the problem.